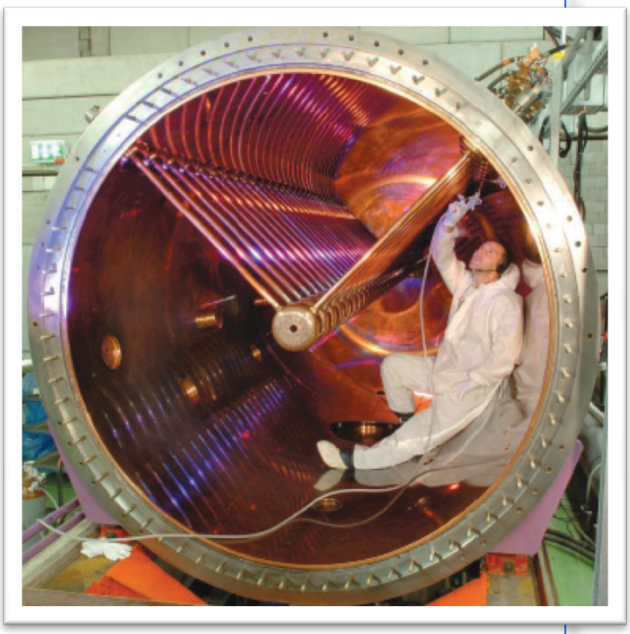
Nuclear Science Division Newsletter

In this issue: **November, 2011**

Hunting for the Magic 120



In August, 2011, a collaboration of over 40 scientists from more than 10 institutions, including DOE's Lawrence Berkeley National Laboratory (Berkeley Lab), began a concerted effort to extend the periodic table to element 120. The element with the highest atomic number (Z) yet created is 118, the heaviest of six new elements produced within the last decade by reactions of calcium-48 (^{48}Ca) hitting targets made of actinides. Unfortunately element 118, produced with ^{48}Ca beams on californium-249 targets (^{249}Cf) is the end of the line for these kinds of reactions, since Einsteinium, the next heavier actinide, doesn't exist in sufficient quantities.

The attempt to make element 120 will instead irradiate thin foils of ^{249}Cf with beams of titanium-50 (^{50}Ti), using an ion accelerator at the GSI Helmholtzzentrum für Schwerionenforschung in Germany. The goal is to push toward the fabled "island-of-stability," where superheavy nuclides may have half-lives on the order of seconds or even years, instead of the microseconds typical of the current superheavy elements. The search will enter uncharted waters, increasing the Z of the projectile beam from that of calcium (Z = 20) to that of titanium (Z = 22) or chromium (Z = 24). While the predicted cross sections using these beams are much lower than those for reactions with ^{48}Ca, they should be accessible with 100-150 days of beam-time.

The experiment ran for eight weeks in 2011 and will continue for six months in 2012. The ^{249}Cf target material was provided by Berkeley Lab, and six scientists from Berkeley Lab's Nuclear Science Division, including postdocs and graduate students, traveled to GSI to participate in the experiment and develop custom computer codes for a fully independent data analysis of the results.

International Workshop on Double Beta Decay and Neutrinos

The 3rd International Workshop on Double Beta Decay and Neutrinos, co-sponsored by Osaka University and its Research Center for Nuclear Physics, LBNL's NSD, and UC Berkeley, was held November 14-17 in Osaka, Japan. Over 90 participants engaged in lively discussions on neutrinoless double beta ($0\nu\beta\beta$) decays, neutrino oscillations, neutrino mass measurements, neutrinos from astrophysical sources and cosmology.

The workshop opened with theoretical (Boris Kayser, FNAL) and experimental (Giorgio Gratta, Stanford) overviews, and concluded with a talk on cosmological and sterile neutrinos by Yvonne Wong (Aachen). KEK Director General Atsuto Suzuki made a special appearance and gave his views on studying Majorana neutrinos at the International Linear Collider. A plethora of $\beta\beta$ experiments were represented at the workshop: AMoRE, CANDLES, CUORE, DCBA, EXO-200, GERDA, KamLAND-Zen, LUCIFER, MAJORANA, NEMO-3, NEXT, PandaX, and SNO+. NSD postdoctoral fellows Tom Banks and Ryan Martin gave invited talks on the CUORE and the MAJORANA projects respectively. More technical talks, on topics such as backgrounds in neutrinoless double beta decay search and instrumentation, were also presented. Other presentations covered astrophysical and solar neutrinos, and reactor and long-baseline θ_{13} measurements by the ANTARES, Daya Bay, Borexino, talks from the Double Chooz, IceCube, MINOS, OPERA, RENO, and T2K collaborations completed the scientific program.

NSD staff contributed heavily to the planning of the workshop, with Kevin Lesko serving as the co-chair of the workshop, Alan Poon as scientific secretary, and Brian Fujikawa as a member of the program committee.

A STAR shines in Berkeley

The Relativistic Nucleus Collision (RNC) group hosted the STAR Collaboration Meeting on November 14-18. This is a regular collaboration wise meeting that takes place typically twice a year. About 90 STAR collaborators participated this meeting.

The meeting covered the gamut of STAR activities, from reports on recent analysis to plans for Quark Matter 2012, plus technical sessions on STAR software and computing, and plans for future upgrades. The recent CD-2/3 milestone for the STAR Heavy Flavor Tracker generated considerable excitement.

In parallel, a collaboration committee reviewed plans for a future STAR tracking software upgrade. This upgrade is critical for the success of recent subsystem upgrades, to allow tracking in the forward direction and to allow for a precision description of the detector, common to both tracking and simulation. The latter point is important for physics with the Heavy Flavor Tracker (HFT).

The collaboration invited a few theoreticians to discuss recent developments in heavy-ion physics. Topics in this meeting included hadron confinement from Dr. Tamar Friedmann (Univ. of Rochester), spectral function of heavy quarkonia from Dr. Peter Petreczky (BNL) and viscous hydrodynamics and dileptons from Dr. Kevin Dusling (Univ. of North Carolina).

Details about the meeting can be found at http://starcollaboration2011.lbl.gov/

NSD takes on Giant crowds at AT & T Park

Upwards of 20,000 people, many of them children, walked through San Francisco's AT&T Park on November 6. This event, sponsored by BayAreaScience.org was the finale of a week of science activities throughout the Bay Area. Mark Alper led the Berkley Laboratory effort of six groups. NSD's contribution was a table that allowed visitors to learn about and measure the natural radioactivity levels of a wide variety of common and not so common materials. The NSD members who participated, were Cameron Bates (also from UC Berkeley), Alan Poon, and Howard Matis. In addition to Berkeley Lab, virtually every college, university, laboratory, agency and major technology company in the Bay Area, spoke to the extraordinary breadth and depth of scientific research in our region. Judging from the reaction of the young visitors, this event helped generate an increased interest in science careers among the next generation. What was even more remarkable was the absorption of everyone in science and technology while the majestic Cal football field and the legacy of the 2010 World Series SF Giants loomed in the background.

Newsletter Notes

Because of the coming holiday break, the next issue will be a combined December/January issue. Look for it in mid-January 2012.

Please send any comments, including story suggestions to Spencer Klein at srklein@lbl.gov.

Previous issues of the newsletter are available at:
https://commons.lbl.gov/display/nsd/NSD+Newsletter